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OCEANUS

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EDITOR: JAN HAHN

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HAHN

Ne cede malis

WE have been most fortunate in 30 years of ship operations. Nevertheless, our ships occasionally do get into trouble, trouble which we have never advertised, being "all in the day's work". The 72 foot 'Balanus', an unloved craft which was sold in 1951, lost her rudder between Woods Hole and Bermuda one black night during a gale. For a while some of those on board did not think they would survive until morning. She is shown on our cover being taken in tow two days later by the U.S.C.G. cutter 'Campbell', whose hull is hidden behind a left-over from the gale.

The 'Atlantis' twice lost a propeller, only to return safely under sail. Once she lost her mizzen mast overboard in the Equatorial Current. Smaller breakdowns of ships or scientific gear in gales and in moderate weather are commonplace.

Our ships and men encounter many a severe storm and misfortunes. They who wish to learn the ocean's nature take these in stride.

Editorial

VOL. VII, NO. 2, NOVEMBER 1960

DURING the cruise of the R. V. 'Chain' in northern European waters many foreign scientists joined the ship for various periods, while still more visited in ports of call. More and more, our ships are working together in joint operations with foreign research vessels such as the R.R.S. 'Discovery II', the 'Winneretta Singer', the 'Helland-Hansen' and the 'Explorer.'

Plans are well underway for the International Indian Ocean Expedition, in which some 17 nations are cooperating. In the North Atlantic, eight European research vessels studied arctic flow in a Polar Front Survey. In the Pacific Ocean, Scripps' ships have worked jointly with Canadian and Japanese vessels. The publication of the Atlantic Ocean Atlas (see p. 14) serves to remind us of the close cooperation with our British friends during the IGY. The increasing awareness of the international aspect of the marine sciences also has led to an increase in organizations and sub-organizations. So many, in fact, that one needs a glossary to decipher the alphabet soup of initials (APO, IUGG, ICSU, SCOR, SCAGI, etc.).

Writing in "Science Progress", Dr. G. E. R. Deacon states: "All marine scientists are under considerable pressure from well-intentioned international scientific and inter-governmental organizations" ——— "Scientists, conscious of the still outstanding need to support the work of individuals and small groups, are inclined to question the need for such multiplicity of organization, and hope that it will settle down into something fairly simple".

HAHN

MY first meeting with Dr. Bigelow was in the early 1920's, about 38 years ago, and we have been working together ever since. There are many who can well envy me this long and productive association with a scientist whose accomplishments are well known. My first assignment for which H. B. was to be my guiding spirit was a cod-tagging program inaugurated by the U. S. Bureau of Fisheries in 1923. I soon found that he was a dynamo of energy, a quick thinker who can put his finger on that which is relevant and play down that which appears to be trivia. He brought my attention to the law of diminishing returns and, although I do not know the exact wording of this so-called law, its intent is evident, and as the years rolled by it saved me—and doubtless others whom he has guided—much useless effort.

HAHN

Scarcely a single species of marine fishes is known adequately—much remains to be learned about their habits.

Dr. Bigelow's many published papers and books, embracing various fields of science, date back to 1902 and he is still very much in the running. His "Fishes of the Gulf of Maine", which appeared in 1925, is by all odds the most popular book on fishes ever issued by our government, packed as it is with exhaustive information useful to the ichthyologist, the fisherman, and the layman alike. It was sold out and a revised edition, published in 1953, already has been gobbled up; at least there were only a few copies left in the government printing office several months ago. The fish book was followed in rapid succession by the publication of "Plankton of the Gulf of Maine" in 1926 and by "Physical Oceanography of the Gulf of Maine" in 1927, treatises that have withstood the test of time. How he produced three large volumes in such a short space of time no one knows, not even H. B. himself as he has on occasion told me. But I think I know most of the answers, namely, that he works relentlessly and knows well his subject, or if he does not, he knows where and how to dig out the answers.

Instead of discussing fisheries biology from a broad standpoint, I shall dwell upon a few of the things that have concerned Dr. Bigelow and myself since we elected to play along with fishes.

In 1940, at a meeting in the New York Aquarium, "Fishes of the Western North Atlantic" was launched. We were assigned to work on the cyclostomes, the sharks, the skates and rays and on the chimaeras, and these proved to be enough to make up the first two volumes. The cyclostome-shark manuscript was completed in about five years, but it was three years later, due to editing and various other delays, before the book appeared in print. As soon as we received the first copies there followed what might be termed the big clean-up, always a joy to H. B., for this represented another milestone. It involved throwing into a large waste basket all the great amount of paper work, galley and page proofs, etc. that went into the finished book. By that time work on Volume 2 was well along and eventually was published in 1952, the same year that the revised edition of "Fishes of the Gulf of Maine" appeared.

I would like to add here the fact that we were fortunate in having at hand in the Harvard Museum of Comparative Zoology, an excellent library and one of the best fish collections in existence. Also, much material was received on loan from other museums and agencies, not only in this country but from various other parts of the world. And many of our colleagues were most helpful in contributing data.

"Known from"

The literature on fish is large, even for a restricted area such as the Gulf of Maine, for which published records date back to, at least, Capt. John Smith in 1616. He was not an ichthyologist, but fishes were an important item in the economy of the colony. One of the shortcomings up to the early part of this century, and to some extent even up to the present time, has been that dealing with geographic range. For example, the range of a cosmopolitan species has been given as "known from the Atlantic, Pacific and Indian Oceans". Good as far as it goes; but we would like to have more precise information. A favorite expression used until recently for Atlantic coast species of fish is "known from Massachusetts to Brazil"; or "from Cape Cod to Brazil", or from some other region in the lower latitudes. Investigation often revealed that only one or a few specimens of a given species were actually recorded from Massachusetts, and information was lacking as to whether from the southern coast or the northern, a matter of interest, for some species occurring along the southern coast have yet to be definitely recorded as far north as Provincetown. Furthermore, some species taken in northern waters occur there only as stragglers. So an abbreviated range can be misleading. I mention this little fact because a great deal of our time and energy (although perhaps not much real brain work as H. B. so aptly has said) has been devoted to scouting the literature and digging out and piecing together, along with our own experiences, a better picture of distribution.

HAHN

This red spider crab was "known from Cuba", but found off New England.

Puzzling factors

No matter how supposedly well known a species may be, when it comes to preparing an up-to-date account we have found that puzzling or uncertain factors are likely to arise. Recently we completed a paper on the capelin, a fish resembling the smelt and found in northern waters. Quite a lot is known about its distribution and spawning habits. The annual catch for Canada has run around two or three million pounds of recent years. But when the Newfoundland statistics first appeared a few years ago, after Canada assumed jurisdiction of that land, the Newfoundland catch was given as over thirty million pounds. We were intrigued by this relatively high figure for the capelin is caught (in Newfoundland at least) almost exclusively along the edge of the shore and only during the six to eight weeks of late spring and into the summer, and is taken chiefly with dip nets, hand scoops, cast nets and beach seines. The population of Newfoundland is small. To total thirty million pounds, about a half-million pounds would have to be taken per day. This was not a typographical error for this amount; with slight variation, it appeared in the last several reports. About 2% of the catch is used for human consumption, the rest for fresh and frozen bait, fertilizer (chiefly for the local potato crop as we learned), cat and dog food, and fish meal. These categories are not broken down in the statistics and only a small fraction of the 98% of the catch is accounted for. We went to some length trying to find out where all this fish ended up, and even had an acquaintance in the General Foods Corporation contact the natives and fisheries interests, while he was in Newfoundland. His opinion was that the annual catch was much exaggerated. Of course all this may not be of vital importance, but it points out that we should be careful how we deal with statistics. And I might add here that, as far as we are concerned, we consider statistics somewhat as a necessary evil that often must be taken into account for we are much more concerned with the life history of a fish and its relationship to other species.

THE CAPELIN

New species

One of our recent chores has been the writing up of a collection of skates and rays from the West Indian region, coast of Central America and the offing of the Amazon River taken in 100-500 fathoms by U. S. Fish and Wildlife Service vessels over the past few years. Part of this area has never been explored within these depths. As might be expected, several new species cropped up and one of them proved to be of particular interest, as well as

SPOONER

Bigelow and Schroeder, an international by-word in the field of marine biology.

In experimental fishing, quantity is not as desirable as quality. These lobsters found in deep water by Mr. Schroeder have led to an extensive fishery.

HAH

troublesome. In most respects it fits the large skate family Rajidae, the members of which all have two dorsal fins. But this species lacks dorsals, and this fact messes up the characters that heretofore have been used to distinguish the Rajidae from other families of skates. Here is a case where, as Dr. Bigelow has commented, we must take the bull by the horns and do something about it. This is one of our problems at the present time. An item of interest that has evolved from collections made in the Gulf of Mexico is the finding of a number of newly-discovered species of a small family of skates, and of a genus of cyclostome, which have their closest known relatives far away in South Africa and Japan. The cyclostome (hagfish or slime eel) is a low order of fish, eel-like in form. Future exploratory fishing may close this wide gap in distribution, but there the matter stands for now.

This article is an adaptation of a talk given on the occasion of the presentation of the H. B. Bigelow Medal on August 10, 1960. (See: Oceanus, Vol. VII, No. 2.)

Depth Ranges

The angler, also called goosefish or all-mouth because of its enormous mouth, a species reaching about forty pounds in weight but usually much smaller, is often thrown ashore during the storms as it is commonly found in very shoal water. But it wanders far offshore and we have recently trawled it down to 470 fathoms. Its presence in shoal to deep water obtains for the year-round, and does not involve long migrations, so far as we know. The common white hake, of which millions of pounds are caught annually by the commercial fishery, is found in greatest abundance in depths less than about 50-60 fathoms and many are taken close to shore. But it is found out to at least 600 fathoms. There are other species in New England waters that have a wide depth range, but for some of them this is brought about by seasonal migrations. It will be interesting to learn why some species of fish dwell in a habitat that includes wide extremes of temperature, types and abundance of food, etc., while others are more restricted.

MR. SCHROEDER, ichthyologist, has been on our staff since the Institution's founding. Co-worker with Dr. Bigelow, he has made many deep water exploratory fishing cruises.

Among the latter we can include the tilefish, found chiefly in 70-100 fathoms, seldom shoaler than 50 or deeper than 150. It ranges along the southern New England coast to the offing of Delaware, and small numbers are found much further south into the Gulf of Mexico. And the redfish — several hundred million pounds are taken annually on our side of the Atlantic, mostly in depths of 20-150 fathoms. In our recent exploratory fishing we caught it along the southern slope of Georges Bank down to about 350 fathoms. As we worked westward the last catch was made in the offing of Martha's Vineyard, although we made many hauls in 100-700 fathoms as far southward as Virginia. As yet we have no answer to why the redfish population stops cold where it does. Neither depth, temperature, nor

HAHN

The all-mouth or goosefish has been known to swallow seagulls and almost everything else but geese.

availability of food appear to give a solution, but there must be some factor which restricts the redfish to waters east of the Martha's Vineyard region.

Lobsters

Also, we have recently added to our knowledge of the habitat of our lobster. From the distant past up to the present time millions of pounds have been taken annually in our coastal waters from New Jersey to the Gulf of St. Lawrence. Occasionally a few, mostly large, were trawled offshore by the commercial fleet, usually in less than about 70 fathoms and these were considered strays from shoaler depths. In June 1948, enroute from Woods Hole to Bermuda on the Woods Hole Oceanographic vessel 'Caryn', I made an otter trawl haul SSW of Martha's Vineyard in 210 fathoms and indeed was surprised to find in the catch three small lobsters, for this was the first evidence that lobster occurred in depths well beyond 100 fathoms. To make a long story short, subsequent exploratory trawling by the Institution's vessels revealed a substantial population of lobsters all along the Continental Shelf slope from the offing of eastern Georges Bank to that of Chesapeake Bay, chiefly in depths of 70 - 200 fathoms.

Soon thereafter, a commercial offshore fishery developed and has continued up to the present time. According to our findings this offshore population is distinct and self-supporting from that of the inshore one, for it consists of all sizes of lobsters from very small to very large and there is as yet no evidence that extensive migrations occur between inshore and offshore.

That this offshore population remained undiscovered for so long a time was due, in part at least, to the fact: (a) Fishing boats, until recently, were not equipped with bottom trawling gear that would enable them to fish much deeper than about 100 fathoms and (b) Such fishing as was done along the fringe of the Shelf in, say, 70 - 100 fathoms was not promising enough to tempt fishermen to explore greater depths.

Improvements in gear and the utilization of electronic devices, allowing for more efficient fishing and for drastically cutting down the time required for operations, have been a great aid in the study of fishes.

We have much to learn about fishes in general. There is scarcely a species concerning which we can close the book. Fisheries biology has merely been scratched, and this brings to mind a quip made many years ago by a Swedish crew member of the U. S. Fisheries schooner 'Grampus', who said to Dr. Bigelow: "The more you live the more by yimminy you find out".

HAHN

An edible red crab (Geryon) found in large quantities off New England at 75 fathoms and deeper has not attracted a commercial fishery.

Moscow visited

by Mary Sears

ON 7 October I returned from a ten-day meeting of the International Council for the Exploration of the Sea, held this year in Moscow. These meetings, held annually since 1902, afford oceanographers, especially biological oceanographers and fisheries biologists an opportunity to discuss mutual problems and plan cooperative programs. Since the United States had to decline the invitation to join the Council just after the war, the Institution has frequently been asked to send an observer to the annual meeting. This was the sixth such meeting I had attended since 1934.

This year the most recent member to join the Council, the U.S.S.R., was the host country. As relatively few of the delegates had previously visited Moscow, much of the time was spent in becoming acquainted and in visiting the laboratories of the All Union Research Institute of Marine Fisheries and Oceanography (VNIRO) and the two sections of the Institute of Oceanology of the U.S.S.R. Academy of Sciences. I felt most fortunate in meeting so many old friends of long standing and in the exceedingly cordial reception tendered by Russian colleagues, first met a year ago at the International Oceanographic Congress in New York.

It was most helpful also to meet and discuss problems connected with editing DEEP-SEA RESEARCH, directly with the translators and interpreters with whom I had been corresponding. The Russian hydrographer presented me with an English-Russian Navigation Dictionary, just off the press, a scientist gave me a two volume dictionary and I had twelve dollars worth of excess luggage because of the generosity of the Russian oceanographers in supplying me with their most recent books and papers, some of which had not yet arrived in the library at Woods Hole.

In return, I presented the Institute of Oceanology with the first copy of the Institution's "Atlantic Ocean Atlas" after first displaying it at a session of the Council's Hydrographic Committee. It was so well received that a number of librarians requested the Atlas within a day or two of the delegates' return home.

A fisheries biologist, one of the two women aboard the Russian trawler that put into Atlantic City last spring with a sick seaman aboard, visited me in search of the sources of data on the menhaden and herring in the northwest Atlantic. Her headquarters are at the Baltic Research Institute of Marine Fisheries and Oceanography in Kaliningrad, but the work there is not limited to the Baltic. Rather, they fan out over the North Atlantic to the Gulf Stream and even study the menhaden haunting the inshore waters along the entire eastern seaboard of the United States.

'Mikhail Lomonosov', the research vessel of the Marine Hydrophysical Institute of the Academy of Sciences of the U.S.S.R.

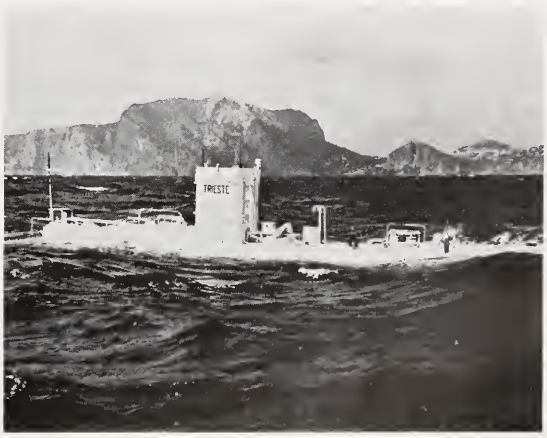
In contrast to the United States, more than fifty per cent of the oceanographers in the U.S.S.R. are women, some even are directors of laboratories. Their other characteristic is their youth. About twenty-five years ago, three outstanding men, N. N. Zubov, V. V. Shuleikin and V.N. Nikitin stimulated thirty young students to study oceanography. Twenty of these are still active today, but many of those whose work is known in the United States graduated from the university within the last ten years. They work long and hard, usually spending at least seven months consecutively at sea each year, the women leaving their small babies at home. On their return, their data and material is worked up and they are ready to sit down and write their papers. The program is so intensive that vacations of six to eight weeks are the rule. While a school teacher's salary falls between that of a university student and a factory worker, an oceanographer, particularly when he also holds a university appointment, holds an enviable position making at least 48,000 rubles ($12,000) and possibly twice that amount. The young married couples between them do about as well. Finally, while their research vessels are much more commodious than ours, their laboratories are every bit as crowded. Five more large research vessels are abuilding to be added to the already existing fleet, but the building program ashore appears to be progressing more slowly, largely, I suspect because of the extreme need for new living quarters after the destruction during the war and the absence of home construction for the past forty years.

Associates' News

Annual Dinner

THE Annual Dinner Meeting of the Associates' of the Woods Hole Oceanographic Institution will be held in early February in New York, probably at the American Museum of Natural History.

The guest speaker will be the noted Swiss scientist Jacques Piccard who has made many dives in the Bathyscaphe conceived by his father, Auguste Piccard. On January 23, 1959 Dr. J. Piccard accompanied by Lt. D. Walsh, USN, went to a depth of 35,600 feet into the Mariana's Trench near Guam.



The Bathyscaphe 'Trieste' returning to the surface south of Capri after a dive to a depth of 3,000 feet. Dr. Piccard will lecture about his dives at the Associates' Dinner next February.

OFFICIAL U.S. NAVY PHOTOGRAPH

Tons of Tuna!

ON November the 12th, six tons of fish were taken by F. J. Mather III on the R.V. 'Crawford' about 120 miles southeast of New York. Just one day out of Woods Hole, Mr. Mather set a Japanese long line at the 1,000 fathom curve in the Hudson Canyon. (39° 15′ N., 71° 54′ W.) Four hours later he brought in 34 bluefin tuna, ranging from 240 to 300 pounds, four albacore of 15 pounds, one big-eye tuna, four sharks and two fish whose name was garbled in the radio transmission. Two other fish were lost. Seventeen of the bluefin tuna were tagged and sent on their way.

It was not known how many baskets and hooks of long line were set out. The 'Crawford' has a total length of six miles of line on board to be set at a depth of 180 to 200 feet below the sea surface.

Mr. Mather's cruise was aimed at investigating the migratory pattern of tuna and other game fishes. We are awaiting his return with the 'Crawford' before reporting (in the March issue) on the significance of this catch and any others he may have made during the cruise.

J. WALTER GREEN

Hurricane "Donna" which struck in September, surprised the 'Atlantis' and the 'Aries' at our docks. Some of the Starboard plates of the 'Atlantis' were bent in, but otherwise the ships escaped without damage. In this fine photograph by J. Walter Green it becomes clear why there was some damage to the pier and further sinking of the foundation of the hydraulic laboratory.

MUNNS

The research vessel 'Chain' at sea, photographed from the R.V. 'Crawford' during "Gulf Stream" 1960, our multiple ship operation held earlier this year. The 'Chain' is towing a series of thermistors at her stern to obtain a constant profile of water temperatures from the surface to a depth of 450 feet.

ATLANTIC OCEAN ATLAS

OF

TEMPERATURE AND SALINITY PROFILES AND DATA

FROM THE

INTERNATIONAL GEOPHYSICAL YEAR OF 1957 - 1958

BY

F. C. FUGLISTER

Volume I of a series of oceanographic atlases was published in October 1960 by the Institution as part of our contribution to the International Geophysical Year 1957-58. Prepared by oceanographer F. C. Fuglister and his associates, the book contains 46 large colored charts showing the salinity and temperature of the North and South Atlantic Ocean from the surface to the bottom. The ocean bottom obtained by precision echo sounding also is shown on the profiles. Eight other profiles in color provide detailed temperature information for the upper 500 feet of water across the ocean at different latitudes. It is in these upper layers that most of the seasonal and geographical changes take place. The data from which the charts were drawn also are included in the atlas.

Measuring 12 x 17 inches, containing 210 pages and printed on paper made to withstand the rigors of shipboard use, the atlas was designed both as a reference book and a working tool for oceanographers, fishery scientists and other students of the sea.

Never before has oceanography had such a complete three-dimensional description available. The German "Meteor" Atlas, hitherto the most complete and remarkable publication dealt with the South Atlantic only.

The observations for the atlas were made between September 1954 and July 1959 on board our research vessels 'Crawford' (Captain David Casiles), 'Atlantis' (Captains W. S. Bray, A. D. Colburn, Jr. and E. J. Mysona) and 'Chain' (Captain W. S. Olivey), and on board the R.R.S. 'Discovery II' (Captains S. S. F. Dalgleish and J. Gray) of the (British) National Institute of Oceanography.

This work has not been of a nature exciting to the general public; nevertheless, it represents a milestone in our knowledge of the ocean. It is of interest to note some of the background of the preparation of this atlas:

Some 40,000 miles of hydrographic sections, not including the distances traveled from home-port to home-port. (665 degrees of Latitude and Longitude, all figured at 60 miles per degree).

The observations at sea on which the atlas is based were made during the four years by scientific parties, totaling only 16 members from Woods Hole. No British scientists are included here. Figures denote the number of cruises:

They were:

Wm. G. Metcalf 6, N. A. Rosa 5, J. R. Barrett, Jr. 3, D. Densmore 3, D. A. McGill 3, R. G. Munns 3, J. L. Schilling 3, L. V. Worthington 3, R. Olsen 2, and each on one cruise: J. Chase, Wm. Dunkle, Jr., F. C. Fuglister, R. A. Lufburrow, A. R. Miller, A. C. Neumann and J. Valois (M.B.L.).

Last, but not least, we should mention the ships' personnel who spent the four years being away from home for even longer periods than they usually are and, as always, provided their unfailing cooperation to "science".

For a year and a half the enormous task of plotting and checking was done by F. C. Fuglister and (Mrs.) Eloise Soderland. Gale C. Pasley Jr. directed the drafting and art work with (Mrs.) Mary K. Minot designing the book. John W. Stimpson devised the method of reproducing the bathythermograph records.

An edition of 3,000 copies was printed and distributed to libraries around the world. The work was financed by the National Science Foundation in support of its IGY Interdisciplinary Research Program. Copies may be purchased from the Institution at $11.00 postpaid.

Work is now in progress on Volume II which will present worldwide deep-ocean data.

J.H.

* See: Oceanus, Vol. V, nos. 3 and 4, "IGY issue"

The "raw material" behind the Atlantic Ocean Atlas. The scientific party o/b the R.V. 'Crawford' ready to make IGY observations eastward along 40° North and westward along 16° North Latitude. From left to right: (standing) D. A. McGill, J. Chase, F. C. Fuglister, N. A. Rosa and G. W. Metcalf. (kneeling) D. Densmore and R. Olson.

The area covered by observations for the IGY Atlas is shown on this chart. The majority of the transatlantic passages were made by the small (125 feet) 'Crawford'. Not shown are the tracks made by the ships going to and from the beginning of each section. Many additional observations and cross-checks were made during these passages.

IN the "Atlantic Ocean Atlas" Mr. F. C. Fuglister has presented, in handsome bound form with colored plates, the vertical profiles of temperature and salinity made by ships of the British National Institute of Oceanography and of the Woods Hole Oceanographic Institution during the International Geophysical Year. The Atlas helps fulfill the need for a systematic presentation of oceanographic data.

During the early years of oceanography — up to about 1930 — oceanographic serial data from single expeditions were usually rather fully documented and published **in extenso,** as many-volume expedition reports. Often atlases were included in these reports.

Starting in 1930 the field work in the United States and Japan became more or less continuous, rather than centered around individual expeditions, and full publication and discussion ceased. The data were published in tabular form, in annuals like the Bulletin Hydrographique, but, without presentation in graphic form, it remained essentially buried in a maze of figures. The vertical profile is one of the most effective forms of presentation, and Mr. Fuglister's Atlas will be of great use to scholars.

We can hope that comparable summaries of the oxygen data, of σ_t, specific volume, of dynamic current calculations, etc., will, in due time, also appear. Whatever the editorial reservations of those presenting the IGY data may be regarding the accuracy of the oxygen data, for example, it is certain that the withholding of them will ultimately do more harm than presentation in a somewhat dubious form.

Henry Stommel

The brave little 'Crawford'

HAHN

Mr. Metcalf fastens a Nansen bottle to the wire at one of the more than 850 IGY 'stations'.

IGY Report

THE ALBATROSS ARE FRIENDLY —
SOMETIMES A MENACE TO NAVIGATION

DINING IS LEISURELY
SERVICE SUBLIME

Making hydrographic stations, lowering BT's, marking echo-sounder records, correcting thermometer readings, titrating salinities and oxygens', day and night for weeks on end is not always a great joy. The biting wit of Conrad Neumann's numerous drawings provided relaxation during the many weary weeks.

IGY Atlas

BY DANA DENSMORE

OCTOBER 1960 saw the publication of a project that has taken nearly four years to complete: "The Atlantic Ocean Atlas of Temperature and Salinity Profiles and Data".

Working within the framework of the International Geophysical Year, 1957-1958 ships of the Woods Hole Oceanographic Institution, in association with the British National Institute of Oceanography, ranged the Atlantic with a series of transverse profiles from 58° North to 32° South Latitude designed to outline the oceanic circulation. Two major meridional sections were also made in the western North Atlantic and four others in the Caribbean.

The research vessels, 'Crawford', 'Atlantis', 'Chain' and the R.R.S. 'Discovery, II' made the nearly 850 hydrographic stations covered during this period, a particularly homogeneous effort inasmuch as all the observations were made by the same small group employing the same instruments and techniques, under the supervision of L. V. Worthington, W. G. Metcalf, A. R. Miller and F. C. Fuglister.

The four South Atlantic sections retraced four of those done thirty years previously by the German research vessel 'Meteor', affording an excellent time-scale comparison, while many of our own stations were spot-checked on later cruises.

This was only the beginning. Countless hours of sheer drudgery were necessary to mold this great mass of data into a coherent presentation; bathythermograph traces, position plotting, corrected bathymetry, thermometer corrections, temperature and salinity profiling, ending finally with the painstaking drafting and endless checking of galley proofs.

There was much accomplished that has not been included in this Atlas: Carbon 14 work, productivity analyses, meteorological observations, oxygen and phosphorous sampling and sediment coring, and — an immeasurable benefit in contacts with others in the marine sciences up and down both shores of the Atlantic.

JUNNS

A sea comes to wash the hydrographic winch on the stern of the 'Crawford'.

R. V. Chain's cruise

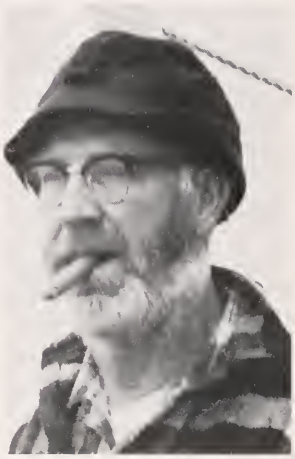
to

Northwestern Europe

The R. V. 'Chain' (Captain E. H. Hiller) returned on November 12th from a 4½ months cruise in northern European waters. The international co-operation which was started on a small scale some years ago blossomed this summer. Fourteen scientists from six European nations took part in the work on board the 'Chain' while joint programs were carried out with the Norwegian vessels 'Helland Hansen' and 'H. U. Sverdrup', the British R.R.S. Discovery II' and the Scottish 'Explorer'.

The primary purpose of the cruise was the geological and geophysical investigation of the bottom in northwestern European waters and between the Bahamas and Scotland. Two hydrographic investigations were made also. One by Dr. J. B. Hersey in a study of the polar front in the Norwegian Sea, the other by L. V. Worthington, together with the Scottish 'Explorer', examining the outflow of Arctic water over the Iceland-Faroe Ridge.

Chief scientists during various legs of the cruise were: Dr. E. E. Hays, Dr. J. B. Hersey, L. V. Worthington and Dr. R. H. Backus.



CAULFIELD

Dr. E. E. Hays in his arctic uniform

Surrounded by the steep, bleak hills of Vestmanhavn, Faroe Islands, the 'Chain' is moored outside the 'Explorer' of the Marine Laboratory, Scottish Home Department (Aberdeen). The other vessel is the 'Ernest Holt' of the Fisheries Laboratory in Lowestoft, England.

MUNNS

During the international meetings at Helsinki, the R. V. 'Chain' (foreground) kept company with two German oceanographic vessels. the 'Joh. L. Krüger' (East Germany) and the small Forschungskutter 'Hermann Wattenberg', of the University of Kiel (West (Germany).

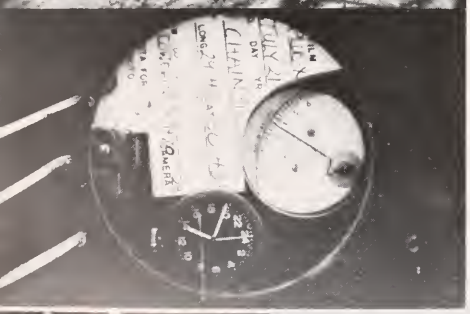
CAULFIELD

The afterdeck of the 'Chain' beyond the Arctic Circle or: "Oh, for a cruise to the Caribbean."

CAULFIELD

In multiple ship operations, transfers of men and equipment generally are made by rubber raft. Here, a load of frozen water samples for total phosphate analysis are brought from the 'Chain' to the 'Explorer' rolling heavily in a swell.

MUNNS

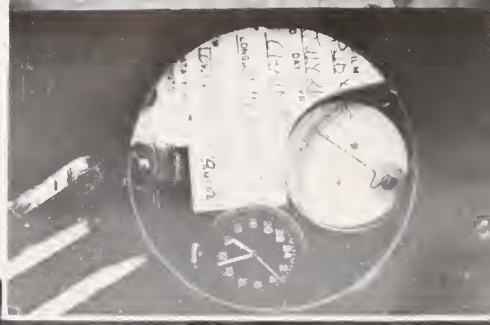


These bottom photographs were made during the 4½ month's cruise of the 'Chain', while over the rift in the Mid-Atlantic Ridge, at a depth of 3700 meters (± 11,200 feet).

The object on the end of a hose and wire is a compass.

'Chain' cruise #13

Photographs of the Mid-Atlantic Ridge at 50° 43′ North and 29° 47′ West



Soundings

Atomic submarine brings Polar Sea plankton

ZOOGEOGRAPHY concerns itself with the understanding of the geographical distribution of animal species. In the oceans it is believed that environmental factors such as temperature and/or salinity are important in deciding the distribution of zooplankton animals.

One of the fundamental questions in plankton zoogeography has concerned the interrelationship of the surface planktonic species found in the two great oceans the Atlantic and Pacific. Obviously, somewhere under the great expanse of the Arctic ice floes planktonic animal species belonging to either oceans intermingle. Such intermingling, if found, would undoubtedly represent a biological boundary between the oceans which may or may not be reflected by other oceanographic barriers.

During the International Geophysical Year 1957-58, attempts were made to locate the biological boundary by sampling for plankton from the Arctic ice islands. Under these conditions plankton nets had to be lowered through holes in the ice and towed vertically through the water column. As a result the area covered by such sampling was quite restricted and the amount of plankton retained during the haul was quite small. Thus the problem remained of obtaining sufficiently large numbers of samples beneath the ice on a definite traverse between the Atlantic and Pacific Oceans. The obvious sampling vehicle was one of the Navy's new atomic submarines.

Dr. S. Galler of the Office of Naval Research provided the necessary impetus and funds for the development of a continuous plankton sampling apparatus for operation aboard submarines. Mr. A. Vine of this Institution spearheaded the development with the cooperation of C. S. Yentsch and G. D. Grice. Mr. R. L. Rather of the Commercial Engineering Company of Houston performed the phenomenal feat of engineering and building the apparatus within one month.

The continuous plankton sampling apparatus consists of a rotary turntable fitted with 24 nets 12 inches long and ¾ inch in diameter. Water is passed through the nets by the forward motion of the submarine, each net is allowed to filter for one hour, after which a timing mechanism in the apparatus rotates another net into the filtering position. The sampling apparatus is completely self-contained, designed to be operational for long periods and to withstand extreme pressures and cold temperatures.

We were able to test the apparatus on the recent cruise under the Arctic by the atomic submarine 'Seadragon.' During this trip the sampler collected some 204 samples. Dr. Grice is now in the process of identifying and classifying the organisms, and thus it would seem possible that a highly interesting question in plankton zoogeography is in the process of being settled. It should be noted that this represents a "first" in plankton sampling from a submarine and also stands out as a classic example of the scientific information that can be obtained by the cooperative efforts of oceanographers and submariners.

C.S.Y and G.D.G.

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